U. S. DEPARTMENT OF AGRICULTURE.

FARMERS' BULLETIN No. 24.

HOG CHOLERA AND SWINE PLAGUE

BY

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U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF ANIMAL INDUSTRY,
Washington, D. C., February 1, 1899.

SIR: I have the honor to transmit herewith for publication as a Farmers' Bulletin an article on "Hog Cholera and Swine Plague." The annual losses from these two diseases to the farmers of this country are variously estimated from $10,000,000 to $25,000,000. It is the object of this bulletin to tell the farmer how to identify these diseases, how to treat them, and how to prevent them; and it is believed that such information, presented in a concise and systematic manner, will prove of great value to the swine-growers of this country. A few additions are made in this edition.

Respectfully,

D. E. SALMON,
Chief of Bureau of Animal Industry.

Hon. JAMES WILSON,
Secretary.

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HOG CHOLERA AND SWINE PLAGUE.

INTRODUCTORY.

The annual losses from hog cholera in the United States are unquestionably very heavy, for, although all diseases of swine are called cholera by people not familiar with them, scientific investigation has confirmed the opinion of our farmers that we have a widespread and destructive plague to which the term hog cholera may be appropriately applied. The researches of the Bureau of Animal Industry, conducted in the most thorough and systematic manner and with the aid of all the appliances of modern science, have shown that there is another disease, called swine plague, which appears to be almost as common and fatal as hog cholera.

These two diseases resemble each other very closely in their symptoms, and it requires an examination of the internal organs after the animal's death, and in many cases a microscopical study, to clearly distinguish between them. Fortunately, we are able to formulate methods for the prevention, cure, and eradication of these diseases which may be applied with the same success to both. Hog cholera and swine plague are not only similar in symptoms, but in their effect upon the bodies of the affected animals. They resemble each other in that both are caused by bacteria; they must be combated by measures which will prevent exposure to these bacteria or destroy them after they have been introduced upon the premises, and the sick animals must be treated by remedies which will reduce the fever, stop the multiplication of the germs, and assist the affected organs in resuming their normal functions.

The difficulty of distinguishing between the two diseases is, therefore, *of no great consequence in the practical work of controlling them.* It is important to know that one or the other of these maladies is present, because this knowledge leads at once to the adoption of the measures applicable to the treatment of infectious diseases. Knowing that we have either hog cholera or swine plague to deal with, we are safe in carrying into effect the treatment recommended in this bulletin, because the agents which destroy one of these germs will generally destroy the other.

There are other infectious diseases which sometimes attack hogs, but they have either not been introduced into this country or have never approached in their destructive characters the two diseases named. The erysipelas of the continent of Europe appears to be the most fatal of the swine diseases in the countries where it is known. It has, however, never been recognized in America and probably has never been introduced on this continent. A few years ago it was proposed by enthusiastic though reckless investigators to introduce the virus of erysipelas as a vaccine for the prevention of hog cholera. The investigations of the Bureau showed, however, that the diseases were not similar; that hog cholera could not be prevented by the vaccine of erysipelas; and that the only effect of the proposed measure would be the introduction of a new plague, probably as destructive as the dreaded hog cholera.

This incident is referred to because it is one of the clearest illustrations we could have of the value of the scientific investigations conducted by the Government and the necessity of an official institution in this country competent to give advice on such important questions. These diseases can only be managed in the light of a thorough knowledge of their nature and characters; otherwise, the chances are that efforts for their suppression will lead to harm rather than to beneficial results.

There is a disease known as anthrax which may attack all species of warm-blooded animals and sometimes affects the hogs in limited areas of this country. This disease does not spread from farm to farm with the rapidity nor to anything like the distance that is common with hog cholera. When it exists, cattle and sheep, and often horses, are also affected; and the hogs usually contract it from eating the carcasses of animals that have died with it. Anthrax is confined to certain regions of the country, and is seen in those regions year after year. It is not a common disease with hogs.

These are about the only diseases liable to be mistaken for hog cholera and swine plague, and as one of them has never been seen in this country, and as the other is infrequent and more often affects other species of animals, it is plain that any contagious disease confined to swine which breaks out in this country is in all probability either hog cholera or swine plague.

GENERAL CHARACTERS.

Hog cholera and swine plague are both very fatal and destructive. They affect hogs in all parts of the United States, and cause heavy losses, which have been estimated to reach from $10,000,000 to $25,000,000 annually.

Owing to the resemblance in the features of the two diseases and the impossibility of distinguishing between them except by scientific investigation, we can not say what proportion of this loss should be

ascribed to one disease and what to the other. Both diseases are known to be common, and both spread by infection.

Hog cholera is particularly fatal to young pigs, and often attacks them when the old hogs escape. The older animals have a greater power of resistance to the virus, and this power, which is also known as immunity, is increased when hogs have been exposed and only so slightly infected that they have recovered after an illness of some duration, or without showing any evident symptoms of the disease. In other words, if hog cholera breaks out among a herd of swine and is checked and apparently eradicated by medical treatment, the hogs that are saved are capable of resisting the contagion on the premises, while purchased hogs that have not been exposed will, when put with the others, contract the disease and die. This shows that the virus has remained upon the premises and the hogs have been saved not by the destruction of the contagion, but by keeping the infected hogs alive until they became immune. This is an important fact, and one which should be kept constantly in mind in applying measures of prevention.

The virus of hog cholera is more tenacious, more resisting to the conditions which affect the vitality of bacteria than that of swine plague, and it is also more easily spread and communicated to healthy animals. Swine contract hog cholera by taking the virus into the body with the food or drink, by inhaling it with the air, and less frequently by its gaining entrance through the surface of a fresh wound. On the other hand, the virus of swine plague is generally, if not always, taken into the lungs with the inhaled air.

The time that elapses between infection and the appearance of the first symptoms of illness, known as the period of incubation, varies from four to twenty days. During this period the germs are multiplying slowly and are gradually overcoming the vital powers of the animal by means of poisonous substances which they produce as the result of their growth.

SYMPTOMS.

The symptoms of serious diseases of swine are not as characteristic as with the larger animals. In the most acute and most severe cases the animals die very suddenly, either before sickness has been observed or after they have been ill but a few hours. Such cases are seen most frequently when the disease first appears in a herd. In the greater number of cases the progress of the malady is slower, and there is consequently a much better opportunity to observe the symptoms. There is first seen the signs of fever, shivering, unwillingness to move, more or less loss of appetite, elevation of temperature which may reach 106° to 107° F.; the animals appear stupid and dull, and have a tendency to hide in the litter or bedding and remain covered by it. The bowels may be normal or constipated at the beginning of the attack, but later there is generally a liquid and fetid diarrhea, abundant, exhausting, and per-

sisting to the end. The eyes are at first congested and watery, bu soon the secretion thickens, becomes yellowish, accumulates in the angles and gums the lids together. The breathing is more rapid that usual and may be oppressed and labored in the later stages. There is a cough, which, however, is not very frequent, and generally heard when the animals are driven from their bed. It may be a single dry cough, or it may be paroxysmal. The skin is often congested and red over the abdomen, inner surface of the limbs, under surface of the neck, and on the ears. The color varies from a pinkish red to dark red or purple. An eruption is sometimes seen, which leaves crusts or scabs of various sizes over the skin. There is rapid loss of flesh, the animal grows weak, stands with arched back and the abdomen drawn up, and walks with a tottering, uncertain gait. There is less and less inclination or ability to move, and the weakness and exhaustion increase until death results.

The symptoms of swine plague in many cases are not noticeably different from those of hog cholera. Frequently, however, the lungs are extensively inflamed in swine plague, and in that condition the breathing is more oppressed and labored, and the cough more frequent and painful.

The course of these diseases varies from one or two days to two or three weeks.

APPEARANCES ON POST-MORTEM EXAMINATION.

The germs of hog cholera have a habit of collecting or growing in clumps in the blood vessels, which leads to a plugging of the smaller vessels, with frequent rupture and escape of blood. This causes red spots where the blood leaves the vessels and collects in the solid tissues. These spots are variously referred to as petechiæ, ecchymoses, hemorrhages, and extravasations of blood. They are common in hog cholera for the reason given. In swine plague the bacteria are evenly diffused through the blood, never form plugs, and therefore hemorrhages from this cause are not seen.

In the most acute forms of hog cholera the changes seen in the various organs consist principally of these red spots caused by hemorrhages of greater or less extent.

The spleen is generally enlarged to from two to four times its normal size, is soft, and engorged with blood.

The blood extravasations are frequent in the lymphatic glands; beneath the serous membranes of the thorax and abdomen, and particularly along the intestines; on the surface and in the substance of the lungs and kidneys; on the mucous surface of the stomach and intestines; and in the connective tissue beneath the skin. The contents of the intestines are sometimes covered with clotted blood.

The diseases of Europe which appear very closely related to our swine plague (*schweineseuche, wildseuche*) also have a hemorrhagic form,

but this has not been observed in America, although hemorrhagic inflammation of the stomach and intestines has been seen in swine plague. Cases of swine plague with external swellings caused by an infiltration of yellow lymph in the subcutaneous connective tissue, generally of the neck, have been seen, but are rare in this country.

The subacute and chronic forms of hog cholera and swine plague are more common. In this form of hog cholera the principal changes are found in the large intestine and consist of ulcers which appear as circular, slightly projecting masses varying in color from yellowish to black. Occasionally these ulcers are slightly depressed and uneven in outline. When cut across, they are found to consist of a firm, solid growth extending nearly through the intestinal wall. They are most frequent in the cæcum, upper half of the colon, and on the ileo-cæcal valve.

In the chronic form of the disease the spleen is rarely enlarged; the lymphatic glands of the affected intestine are enlarged and tough. In the more acute cases lung lesions may be found, varying from collapse and œdema of the lung tissue to broncho-pneumonia.

In swine plague the lungs are often found inflamed, and to contain large *numbers of small points, which may be made out* by *loss of color*, where the life of the tissue has been destroyed (necrotic foci). There may be also found in the lungs large cheese-like masses from 1½ to 2 inches in diameter. Inflammation of the serous membranes is very common in swine plague, and this may be found affecting the pleura, pericardium, and peritoneum, accompanied with fibrinous, inflammatory deposits on the surface of these membranes. There may be congestion of the mucous membrane of the intestines, particularly of the large intestine; or the disease in this region may be more intense and lead to a croupous inflammation with the formation of a fibrinous exudative deposit on the surface.

In hog cholera the first effect of the disease is believed to be upon the intestines, with secondary invasion of the lungs. In swine plague the first effect is believed to be upon the lungs, and the invasion of the intestines a subsequent process.

Briefly reviewing these changes, we find that the most characteristic lesions of hog cholera consist of:

(1) Hemorrhages, particularly in the subcutaneous, submucous, and subserous connective tissue; in the lymphatic glands, and in the various organs of the body.

(2) Ulcerations of the large intestines.

(3) Collapse of lung tissue, and, less frequently, broncho-pneumonia.

The most characteristic lesions of swine plague are:

(1) Inflammation of lungs; numerous small necrotic points in these organs, or a few larger cheesy masses.

(2) Inflammation of serous membranes with fibrinous deposits.

(3) Congestion of mucous membrane of intestine, or inflammation of the same with fibrinous deposits.

Notwithstanding this clear difference in typical cases, there are many outbreaks where it is difficult to make a diagnosis even after post-mortem examination, because both diseases may be affecting the same animal at the same time, or the changes may resemble both diseases without being very characteristic of either. In such cases it is only by microscopic examination and cultivation of the germs that a reliable diagnosis can be made.

THE CAUSE OF THESE DISEASES.

Both hog cholera and swine plague are caused by bacteria, which have now been so carefully studied that they may be easily identified by persons accustomed to bacteriological researches. The hog-cholera germs are slightly larger and more elongated than those of swine plague; they are provided with flagella, or long thread-like appendages, which enable them to move rapidly in liquids; while the swine-plague germs have no such organs, and are unable to move except as they are carried by the liquid in which they float.

Hog-cholera bacteria, when inoculated in minute doses, are fatal to mice, rabbits, and guinea pigs, and in large doses may kill pigeons. Swine-plague germs are fatal to these animals and also to fowls.

Hog cholera may be produced experimentally (1) by exposing well hogs to diseased ones in the same pens; (2) by feeding the internal organs of diseased carcasses or cultures of the germs; (3) by hypodermic injection of cultures of the germs in doses of one-half to 1 cc. or greater.

Swine plague may be produced experimentally (1) by cohabitation; (2) by injecting cultures of the germs into the lung tissue.

In some outbreaks the swine-plague germs may produce the disease if they are injected hypodermically, but as a rule the swine plague of this country can not be communicated in that way. Cultures of the bacteria of swine plague have been fed to hogs, and have been sprayed into the air which they were breathing, without causing the disease.

Both diseases are produced by injecting cultures of their respective germs directly into the blood vessels.

From the results of experiments with these diseases it has been concluded that the germs of hog cholera find their way into the bodies of swine principally with the food and drink and with the inspired air; while those of swine plague are taken almost entirely with the air, or, at least, they almost invariably gain entrance through the lungs.

Hog-cholera germs are very hardy and vigorous. They are able to multiply and live for a long time in the water of ponds and streams; they may live in the soil for at least three months, and in accumulations of straw and litter for a much longer time; they withstand drying and other adverse conditions in a remarkable manner.

The swine-plague germs, on the contrary, are very delicate and easily destroyed. They soon perish in water or by drying; the temperature for their growth must be more constant and every condition of life more favorable than is required for the hog-cholera germs. The swine-plague germs are widely distributed in nature and are probably present in all herds of swine, but they are not deadly to these animals except when their virulence has been increased or the resistance of the animals diminished by some unusual conditions. The hog-cholera germs, on the contrary, are not usually present and must be introduced from infected herds before this disease can be developed. The swine-plague germs may acquire sufficient virulence, by encountering proper conditions on one farm, to spread to adjoining farms in the same manner as hog cholera. There are, hence, practically the same conditions to guard against in the prevention of the two diseases.

DIAGNOSIS.

The first question that occurs to the owner of swine when disease appears among his animals is, What is the disease with which they are affected? It is important to briefly consider in this place the nature of the evidence upon which this question is to be answered.

If several animals are affected with the symptoms already enumerated, and if the same disease has been affecting the hogs on neighboring farms, we may decide that one or both of the diseases in question are present, since no other epizootic disease has been recognized in this country.

In anthrax districts there may be occasional small outbreaks of that disease, in which there is great inflammation and swelling of the tongue (glossanthrax), or of the throat (anthrax angina), or simply a fever with no local swellings. If the disease is anthrax, other species of animals, horses, cattle, and sheep, will also be affected.

If, on examining the carcass after death, projecting button-like ulcers are found in the large intestines, we know that hog cholera is present. It must be remembered, however, that these ulcers are not found in the most acute cases, but only in the subacute or chronic form of the disease where life is prolonged a sufficient time for them to form.

If there is inflammation of the lungs and particularly if cheese-like masses are found in the substance of these organs, the disease is probably swine plague.

Small blood spots in the tissues or scattered over the internal organs indicate hog cholera, while inflammation of the serous membranes indicates swine plague.

A bacteriological examination is the final test, but neither this nor inoculation experiments are available to the farmer, for whose use this bulletin is prepared.

PROGNOSIS.

The losses which result from outbreaks of hog cholera and swine plague depend partly upon the condition of the hogs—that is, upon

their susceptibility to the disease—and partly upon the virulence of the contagion in the particular outbreak. If the animals are very susceptible and the contagion very virulent, the loss even in large herds may reach 90 to 95 or even 100 per cent in those cases where the disease is allowed to run its course. In milder outbreaks or with animals more capable of resisting the contagion the losses vary from 20 to 60 per cent. Toward the end of an outbreak a larger proportion of animals will recover than at the beginning. A portion of those recovering will fatten, but others remain lean, stunted in their growth, or never become really healthy animals.

THE TREATMENT OF HOG CHOLERA AND SWINE PLAGUE.

Can hog cholera be cured? and, if so, what remedy will restore the diseased animals to health? These are the first questions asked by the swine-grower, and to his mind this should be the objective point of all investigations. With all diseases of this class, however, prevention is cheaper *and in every way more satisfactory than* medical treatment. The great aim of the Goverment and the farmers should be, therefore, to prevent the spread of infectious diseases. Every swine-grower should use the utmost precautions to prevent the introduction of these plagues into his herd. In spite of such preventive measures many herds will become infected. Until the Federal Government or the individual States enforce measures of eradication, it is, consequently, legitimate to ask and to answer the question as to the proper medical treatment.

Before formulating this treatment it should be explained that a remedy which will cure every case is not to be expected. There has never been discovered a remedy for a single one of the infectious diseases of man or animals which will cure every individual attacked. Some forms of these diseases are so violent and rapid that the animals are dead almost before they are observed to be sick. Under such conditions there is not time for the most active remedy to produce a beneficial effect.

In many outbreaks the type of the malady is less virulent and there is time to treat the animals after they are sick, and also the whole herd after some members of it have shown that they are diseased. For a long time after beginning the investigations of the infectious diseases of swine, the writer was doubtful if any remedy or combination of remedies could be made which would produce any marked effect. The experiments of the last year, however, indicate that treatment if properly applied may be successful. With the assistance of Dr. E. A. de Schweinitz, chemist of the Bureau, and Dr. V. A. Norgaard, inspector, a number of formulas have been developed and used in the field with good results.

The most efficacious formula which has been tried is the following:

	Pounds.
Wood charcoal	1
Sulphur	1
Sodium chloride	2
Sodium bicarbonate	2
Sodium hyposulphite	2
Sodium sulphate	1
Antimony sulphide (black antimony)	1

These ingredients should be completely pulverized and thoroughly mixed. In case there is profuse diarrhea the sulphate of sodium may be omitted.

The dose of this mixture is a large tablespoonful for each 200 pounds weight of hogs to be treated, and it should be given only once a day. When hogs are affected with these diseases they should not be fed on corn alone, but they should have at least once a day soft feed, made by mixing bran and middlings, or middlings and corn meal, or ground oats and corn, or crushed wheat with hot water, and then stirring into this the proper quantity of the medicine. Hogs are fond of this mixture, it increases their appetite, and when they once taste of food with which it has been mixed they will eat it though nothing else would tempt them.

Animals that are very sick and that will not come to the feed should be drenched with the medicine shaken up with water. Great care should be exercised in drenching hogs or they will be suffocated. Do not turn the hog on its back to drench it, but pull the cheek away from the teeth so as to form a pouch, into which the medicine may be slowly poured. It will flow from the cheek into the mouth, and when the hog finds out what it is, it will stop squealing and swallow. In our experiments hogs which were so sick that they would eat nothing have commenced to eat very soon after getting a dose of the remedy, and have steadily improved until they appeared perfectly well.

This medicine may also be used as a preventive of these diseases, and for this purpose should be put in the feed of the whole herd. Care should of course be observed to see that each animal receives its proper share. In cases where it has been given a fair trial, it has apparently cured most of the animals which were sick and has stopped the progress of the disease in the herds. It also appears to be an excellent appetizer and stimulant of the processes of digestion and assimilation, and when given to unthrifty hogs it increases the appetite, causes them to take on flesh, and assume a thrifty appearance.

This is a résumé of the reports from the tests of this medicine during the last year, and while I should prefer, from a scientific point of view, to continue these experiments for another year before venturing to recommend it as a remedy for these diseases, the many urgent requests which have been made upon me for the formula lead me to give it in time for it to be tried by our farmers during the current year. Those who are interested in this subject are earnestly requested to try this

mixture and report their results to this Bureau for the benefit of the hog-raising industry.

Success or failure with this remedy depends largely upon the manner in which it is used. If it is improperly administered, or the hogs left out in cold storms and compelled to remain day and night in mud six inches or a foot deep, under the necessity of searching through this mud to find an ear of corn in order to get anything to eat, the farmer might as well save his money and let his hogs die, as nothing which we have been able to find will save them under such conditions. If, on the other hand, the sick animals can be made reasonably comfortable, and given soft, easily digested food to eat, the medicine, of which we have just given the formula, may be used with confidence that it will give good returns for its cost and the trouble of its administration. Apparently, it is not as beneficial in swine plague as in hog cholera.

In treating hogs for these diseases it must not be forgotten that in nearly all cases there is more or less inflammation of the internal organs, and particularly of the stomach and intestines. To treat such diseases successfully the animals should be kept dry and comfortable, and where drafts of air will not blow upon them. The food must be such as can be digested by the irritated and inflamed organs which are charged with this function. With these general principles in mind the farmer may undertake to treat his sick hogs with a fair prospect of success. He may not save them all, but he should be able to preserve a good proportion of them.

The question now arises, What disposition should be made of the hogs during treatment, and what sanitary measures should be adopted in addition to the medical treatment? When the hogs are first found to be affected with hog cholera or swine plague the lot or pens where they have been confined should be disinfected by dusting plentifully with dry, air-slaked lime, or by sprinkling with a 5 per cent solution of crude carbolic acid. The animals should then all be moved to new quarters. If possible, the sick and apparently well should be separated before they are moved and then put into different lots. This is not essential, but it is an aid to the treatment. The hogs should be kept in dry lots, or pens, where there is no mud, and, *above all*, no stagnant water. It is well to keep these lots disinfected by the free use of air-slaked lime or carbolic acid.

It is not expected by this supplementary treatment that the hogs will be entirely removed from the influence and attacks of germs. This is not necessary. The number of germs which gain access to their bodies may be so reduced by following this plan, however, that the vital force of the system, assisted by the medicine, is sufficient to overcome them.

During this treatment the hogs gain a marked degree of immunity. No doubt this is the result of attacks of the disease from which they recover. This recovery is in spite of the continued infection of the

premises, and even though the hogs which have gone through the outbreak are apparently well and thriving, new hogs added to the herd are liable to be attacked. For this reason five or six months should be allowed to pass before any new hogs are purchased and brought on the premises or before any are sold to be put among other lots of hogs. Young pigs born under such conditions in some cases are able to resist the infection, while in other cases they may suffer severely or die.

If any hogs die during the progress of the outbreak their carcasses should be immediately burned or deeply buried, and the places where they have lain or the ground over which they are dragged should be disinfected with carbolic acid or lime according to the method already mentioned.

SANITARY MEASURES TO PREVENT THE INTRODUCTION OF HOG CHOLERA AND SWINE PLAGUE.

The swine-grower should use every effort to prevent the introduction of the contagion of these diseases upon his premises. If he purchases hogs from a distance or sends his own animals for exhibition at the fairs, he should insist upon their being transported in clean cars, which have been disinfected if they have previously carried swine. When new hogs are brought upon the farm or when his own return from exhibition, they should be rigidly quarantined and not allowed to come in contact with the other hogs on the farm for at least six weeks.

Hogs should not be allowed to run at large in the vicinity of railroads over which swine are transported. Infected hogs are frequently shipped to market, and there are sufficient droppings from the cars in which they are carried to scatter the contagion along the railroad for the whole distance they travel.

When these diseases appear upon a neighboring farm precautions should be adopted to prevent the introduction of the contagion. No one should go upon the fields or into the pens where the sick animals are and then go to another farm where the disease has not appeared. Remember that a particle of manure or dirt the size of a mustard seed from an infected farm is sufficient to start an outbreak that will destroy a herd of swine. A particle of that size may be carried upon the shoes of a visitor, upon the foot of a dog or other animal, upon a wagon wheel, or in a multitude of other ways. Nonintercourse at such a time is therefore the safest rule.

Experience shows that hogs kept up in a pen or small lot are less subject to infection when cholera is in the neighborhood than those which are allowed to run at large or in the fields. It is, consequently, advisable, when there is reason to fear this disease, to keep the hogs in a small inclosure, which should be as dry as possible, and disinfected once a week with air-slacked lime or a 5 per cent solution

of carbolic acid. A small quantity of carbolic acid (3 to 15 drops, according to age) in the drinking water tends to prevent infection and may have a beneficial influence upon the course of the disease.

PREVENTION OF DISEASE BY PROPER BREEDING AND FEEDING.

There is occasionally a herd of swine that does not contract hog cholera even though exposed to the contagion. Two herds may sometimes run together and be exposed to the same extent; one will be nearly or quite destroyed, while the other does not suffer. These facts naturally lead to the inquiry as to whether it is possible to so breed and feed hogs as to largely or entirely prevent the most common diseases. To what extent disease may be prevented in this way, we are not in a position to state, as we are not familiar with enough experiments to enable us to reach a conclusion. It is clear, however, that something can be accomplished in this way, and as the carrying out of the plan would also increase the hardiness and thriftiness of the swine it is certainly worthy of adoption.

The first principle of this method of prevention is to breed only from mature breeding stock which is only distantly or not at all related. The second principle is to select, if possible, animals for breeding stock which have shown, by having passed through an outbreak without becoming affected, that they possess a power of resisting hog cholera. The third principle is to feed the growing shoats upon a variety of food which will lead to normal and harmonious development of all the different organs. The application of these principles must be made by the individual breeder in accordance with his circumstances and surrounding conditions. The breeding from mature animals which are not closely related can be easily adopted by anyone. The selection of stock which has shown that it possesses a power of resisting the disease is much more difficult, and in many cases it will be impossible for the general farmer, though there are many breeders who could experiment in this direction.

The diet of corn alone, upon which the hogs of so large a part of the country are raised, has done more than anything else to weaken the vital powers of these animals. With wheat selling in the markets of the country as low as corn, there is no longer any excuse for limiting the food of hogs to a single grain. Wheat is much better than corn for growing animals, but should be crushed or rolled to give the best results. Ground oats, middlings, bran, and pease may also be used to give variety. It is hardly necessary to add that during the warm months of the year hogs should have plenty of young grass or clover.

By intelligently applying these principles in the production of the breeding stock a strain of animals may be developed which is hardy, vigorous, prolific, and much more capable of resisting disease than is the ordinary inbred and corn-fed stock which is now so generally used by the farmers of this country.

This bulletin is prepared for the practical use of the farmer; it is intended to be suggestive rather than exhaustive; it contains the important points necessary for identifying and controlling the infectious diseases of swine. If its teachings are intelligently and thoroughly followed the losses from these diseases may be greatly reduced. Experience having demonstrated that such beneficial results are possible, it has been deemed best to present this information in a condensed and popular form.

FARMERS' BULLETINS.

The following is a list of the Farmers' Bulletins available for distribution, showing the number, title, and size in pages of each. Copies will be sent to any address on application to Senators, Representatives, and Delegates in Congress or to the Secretary of Agriculture, Washington, D. C.:

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22. The Feeding of Farm Animals. Pp. 32.
23. Foods: Nutritive Value and Cost. Pp. 32.
24. Hog Cholera and Swine Plague. Pp. 16.
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